Parkland College

A with Honors Projects | Honors Program

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Electroplating Pennies Lab

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Electroplating Pennies

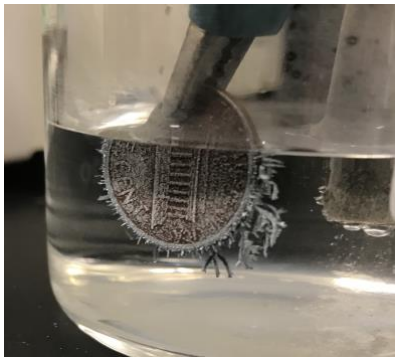
Introduction: The purpose of this lab is to compare methods of electroplating pennies and to decide which method works best. I will also compare the electroplating of pennies made about 10 years apart between the years of 1960-2010. I will also include a penny made in 2017.

Methods: Before each attempted method, each penny was cleaned with dish soap, rinsed with water, and then dried with a paper towel. This was done so that the pennies would not have a barrier of dirt or grease.
The first attempted method was electroplating pennies on a hot plate while in a 250 mL beaker filled with a mixture of 30 mL of a 1M NaOH solution and 30 mL of a 1M Zn_2SO_4 solution. The hot plate was set to level 6, enough for the solution to boil. After allowing the pennies to rest in the 250 mL beaker on the hot plate for 30 minutes, it was concluded that this method failed. The pennies were not electroplated at all. The only observable change was that the Zn in the Zn_2SO_4 solution began to precipitate due to the heat. The precipitant was white.

The second attempted method was electroplating pennies with voltage and a Zn rod. I did this by putting about 60 mL of vinegar in a 250 mL beaker, and then I suspended a penny and a Zn rod about ¾ of the way into the solution. Each were attached to alligator clips. The alligator clips were connected to a controllable power source. The penny was connected to the anode (negative) wire. The Zn rod was connected to the cathode (positive) wire. Then the power source was turned on to about 6 volts. After allowing the pennies to rest for about 25 minutes, it was concluded that this method failed. The pennies were not electroplated. The only observable change was that the vinegar seemed to eat away and corrode small details of the penny.

The third attempted method used the same set up as method 2, except the pennies were not suspended into a vinegar solution. Instead they were suspended in 60 mL of a 1 M Zn_2SO_4 solution. The voltage was also set to 6 volts this time. This method was successful. The penny began electroplating immediately. After about 4 minutes, the penny was completely electroplated, and Zn started to crystalize along the edges of the penny (this is shown in the image below).

image #1:



After discovering the third method was the most effective method, I used the method to collect data and observations from seven different pennies between the years 1960-2017. I electroplated each penny for 5 minutes.

Data/Observations/Results: Out of all three methods, the third method was the most effective. I came to this conclusion due to the fact that it is the only method that worked.

Penny Year	Mass Before Electroplating (g)	Mass After Electroplating (g)	Observations Before Electroplating	Observations After Electroplating
1960	3.07	3.21	-Color: very dark brown w/no luster	-Color: dark grey w/ slight luster on heads side -crystals formed -not as much Zn on tails side

Before:

After:

Penny Year	Mass Before Electroplating (g)	Mass After Electroplating (g)	Observations Before Electroplating	Observations After Electroplating
1970	3.12	3.35	-Color: dull bronze w/ no luster -green spot on tails side	-Color: Dark grey w/ no luster -heavy crystallization on heads side -green spot turned dark grey

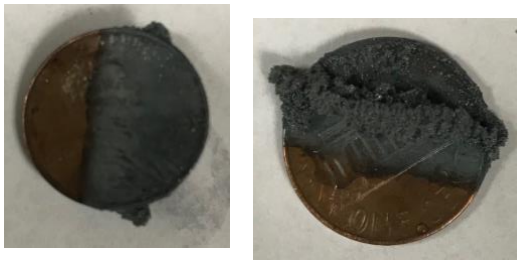
Before:

After:

Penny Year	Mass Before Electroplating (g)	Mass After Electroplating (g)	Observations Before Electroplating	Observations After Electroplating
1981	3.03	3.51	-Color: dull bronze w/ no luster	-Color: Dark grey w/ no luster -heavy crystallization on tails side

Before:

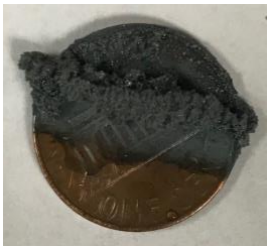
After:



Penny Year	Mass Before Electroplating (g)	Mass After Electroplating (g)	Observations Before Electroplating	Observations After Electroplating
1990	2.47	2.53	-Color: copper color w/ slight luster -Corrosion on tails side	-Color: dark grey w/ no luster -corrosion maintained dark color -crystalization fell off and into the solution

Before: After:

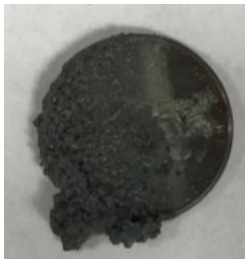
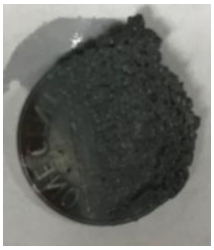


Penny Year	Mass Before Electroplating (g)	Mass After Electroplating (g)	Observations Before Electroplating	Observations After Electroplating
2000	2.50	2.90	-Color: dark copper color w/ very little luster -big green spot on heads side	-Color: dark grey w/ no luster -heavy crystallization on each side -green spot is noticeably darker grey

Before: After:

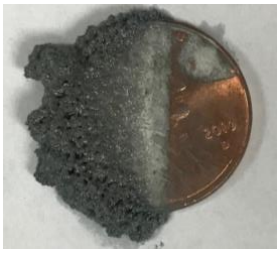
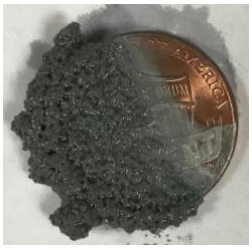


Penny Year	Mass Before Electroplating (g)	Mass After Electroplating (g)	Observations Before Electroplating	Observations After Electroplating
2010	2.48	2.93	-Color: copper color with high luster -no corrosion	-Color: grey with slight luster -very heavy crystallization

Before: After:



Penny Year	Mass Before Electroplating (g)	Mass After Electroplating (g)	Observations Before Electroplating	Observations After Electroplating
2017	2.48	2.87	-Color: copper color with high luster -no corrosion	-Color: grey w/ no luster

Before:

After:

Analysis: Method 1 did not work because the heat caused the Zn to precipitate rather than electroplate. Method 2 did not work because the vinegar solution is an acid. Instead of electroplating and placing Zn onto the surface of the penny, the vinegar ate away top layers of the penny. Method 3 worked very quickly. This is because there was both a Zn rod and a Zn solution. The combination accelerated the rate that Zn plated to the penny. Out of the 7 trials with pennies of different decades, the average mass of Zn electroplated was .307 g. The highest amount electroplated was .48 g for the 1981 penny and the lowest amount electroplated was .06 g for the 1990 penny. I believe the reason for this low Zn transfer in the 1990 penny is due to error. I believe the crystals that were formed on the edge of the penny fell off as the penny was removed from the Zn_2SO_4 solution. This error could have been avoided if the Zn rod was also weighed before and after each penny was electroplated.

Bibliography

Burdge, Julia, and Jason Overby. *Chemistry: Atoms First*. 2nd ed., McGraw-Hill, 2018.

Nicas, Chris, director. *Electroplating Pennies with Zinc*. *YouTube*, YouTube, 15 May 2012, www.youtube.com/watch?v=kMLT6PcWn4w&t=119s.